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OSL RESPONSE OF Al_2O_3:C INLIGHT DOT DETECTORS TO ULTRAVIOLET RADIATION

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ABSTRACT

The commercial dosimeters Al_2O_3:C InLight Dot and the OSL microStar System reader, both developed by Landauer, were utilized in this work for the detection of ultraviolet radiation. The OSL response of Al_2O_3:C InLight Dots was obtained in relation to the parameters of irradiance and illumination time using an UV artificial source. The results showed an increase of the OSL response and a tendency to saturation about 1.7 $W.m^{-2}$ of irradiance and 30 min of UV illumination.

1. INTRODUCTION

The Optically Stimulated Luminescence (OSL) technique has already been applied for ultraviolet radiation dosimetry [1,2]. The most applied material for ultraviolet (UV) dosimetry is Al_2O_3:C, due to its main dosimetric characteristic, as the high sensitivity; it emits a large amount of luminescence stimulated optically per unit of radiation absorbed dose [3], and it showed to be useful for the assessment of ultraviolet (UVB) radiation doses.

The commercial dosimeters of Al_2O_3:C InLight Dot, developed by Landauer, are an option for ultraviolet radiation dosimetry, combined with the OSL technique. It is not possible to submit these detectors to thermal treatments, because they consist of a layer of Al_2O_3:C sandwiched between two layers of polyester in a total thickness of 0.3 mm, and diameter of 0.7 mm. Optical treatments were utilized for "zeroing" the OSL signal [3].

The objective of this work was to study the OSL response of the Al_2O_3:C InLight Dot detectors in relation to the different values of irradiance and of illumination time using of an UV artificial source.

2. MATERIALS AND METHODS

The study was carried out irradiating the OSL detectors using an artificial UV source, a mercury short arc lamp, HBO 200W/2, OSRAM, and a GM 200 double grating monochromator, Bausch-Lomb, at the Center for Radiation Metrology of IPEN. The irradiance measurements of the UV source were obtained using a Delta OHM radiometer. A set of seven detectors was utilized for each study. These studies were repeated 3 times and the results represent the mean values and standard deviations of the OSL responses. The

commercial dosimeters Al_2O_3:C InLight Dot and the OSL microStar system reader, both developed by Landauer, were utilized for the OSL measurements.

3. RESULTS

3.1 OSL Response and irradiance

The OSL response of the Al_2O_3:C InLight Dot detectors in relation to irradiance was initially studied. These detectors were exposed with different irradiance values to ultraviolet light of the artificial source. The interval of irradiance varied between 0.07 $W.m^{-2}$ and 1.7 $W.m^{-2}$. The wavelength and the UV illumination time were fixed as 330 nm and 10 min, respectively.

The OSL measurements were taken immediately after the UV illumination of each detector and the irradiance measurements were taken before and after each exposure of the detectors to ultraviolet light.

Figure 1 shows that the OSL response increases until 0.5 $W.m^{-2}$, presenting then a tendency to saturation up to 1.7 $W.m^{-2}$.

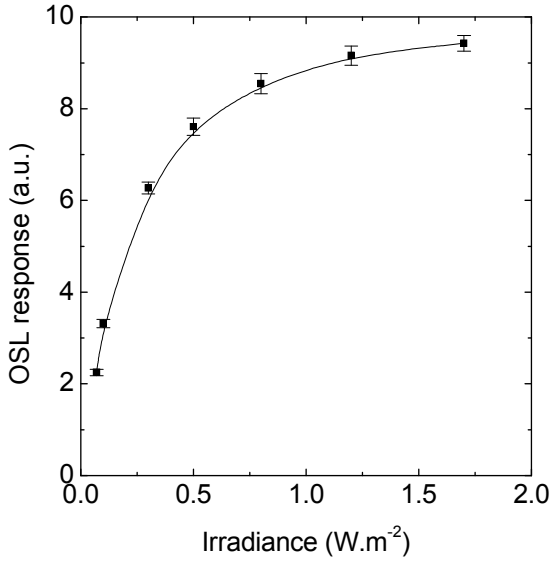

Figure 1 – OSL response of Al_2O_3:C InLight Dot detectors in relation to the different irradiance values from an ultraviolet light. The maximum uncertainty of the measurements was 5.4%.

3.2 OSL Response and UV illumination time

The Al_2O_3:C InLight Dot detectors were exposed during different time intervals to the ultraviolet light from the artificial source. The interval of illumination time varied between 1 min and 60 min.

The wavelength and the irradiance were fixed as 330 nm and 0.5 $W.m^{-2}$, respectively. The OSL measurements were taken immediately after the UV illumination of each detector, and the measurements of the irradiance were taken before and after each exposure of the detectors to ultraviolet light.

Figure 2 shows that the OSL response increases in the whole tested interval of illumination time. These detectors show a significative increase of the OSL signal until 30 min of illumination and then a tendency to saturation.

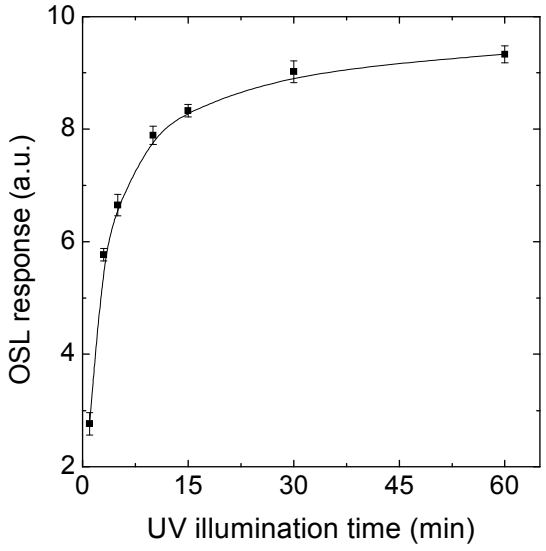

Figure 2 – OSL response of the Al_2O_3:C InLight Dot detectors in relation to the UV illumination time of the ultraviolet light. The maximum uncertainty of the measurements was 5.2%.

4. CONCLUSIONS

The results show that 10 min of UV illumination and the irradiance of 0.5 $W.m^{-2}$ utilized in this study were enough to stimulate the OSL signal of the Al_2O_3:C InLight Dot detectors. The OSL detectors presented a satisfactory response to the studied characteristics and they indicate a potential perspective for UV dosimetry, using the OSL microStar reader.

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REFERENCES

1. Colyott, L. E.; McKeever, S. W. S; Akselrod, M. S. Radiat. "An integrating UVB dosemeter system". *Radiat. Prot. Dosim.*, **85**, pp. 309-312 (1999).
2. West, W. G.; Kearfott, K. J., Bernal, S.; M. "The sunglight OSL response of a commercially available α-Al_2O_3:C personnel dosimetry material". *Radiat. Prot. Dosim*, **119**, pp. 344-349 (2006).
3. Gronchi, C. C.; Cecatti, P. G. S.; Pinto, O. N. C. T, Caldas, E.V.L. "Optical decay of OSL signal of Al_2O_3: C detectors exposed to different light sources". *Nuc. Inst. Meth. Phys. Res. B*, **266**, pp. 2915–2917 (2008).